

MEMORANDUM FOR RECORD

SUBJECT: Mississippi River Headwaters Reservoir Operation Plan Evaluation meeting minutes from October 26, 2002

1. In response to requests from Task Force and Lake Group Reservoir Operation Plan Evaluation (ROPE) volunteers, the Corps of Engineers hosted meetings to present information on the Water Control Plans and hydrology related to the Headwater Reservoirs. The meetings were held on Saturday, October 26, 2002, in the administration building of the Corps of Engineers Cross Lake Recreation Area. Two identical meetings were held at 10:30 a.m. and 1:30 p.m.
2. Approximately nineteen people attended the two meetings (see attached attendance list). Attendees from the various Headwaters lakes regions included: three from the Lake Winnibigoshish/Cass Lake chain/Lake Bemidji area, one from Leech Lake (Boy River flowage), zero from Pokegama, three from Sandy, eight from the Cross Lake/Whitefish Chain and three from the Gull Lake area. In some cases, both upstream and downstream property owners were present.
3. I presented information on the many variables and regulations that affect how the reservoirs are operated. This information included the following:
 - a. A discussion of the Federal regulations that govern the operation of the reservoirs.
 - b. A list of the State (Minnesota Department of Natural Resources) guidelines associated with the operation of the reservoirs.
 - c. A comparison of the drainage area of each reservoir versus the surface area of the reservoir and the storage available in each.
 - d. A discussion of the role that climate and the hydrologic cycle play in water levels to include evaporation, transpiration, interception, infiltration, groundwater flow, runoff, etc.
 - e. An overview of the ROPE study planning effort.
4. My presentation was followed by a lengthy discussion of the above factors as well as the following issues that I was asked to carry forward to the ROPE study team.
 - a. Include the effect of water levels on sewer systems, both upstream and downstream, in the ROPE economic analysis (both private and central systems).

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b. Place the Geographic Information System (GIS)-based maps that were handed out at this meeting on the ROPE web site so interested parties can see the drainage basin delineations for each reservoir.

c. Attach a description of the Corps' flowage rights to the title of all affected landowners (similar to what was done around Lake Traverse).

d. Consider the effects of lake/river water levels on groundwater and vice versa. What effect does irrigation have on groundwater levels and, in turn, on surface water levels?

e. Consider the Bemidji Sewer Plant effluent (and others) in the water quality analysis.

5. Some information on proposed modifications to Section 21 of the Water Resources Development Act of 1988 was presented following the ROPE meeting. The details of that meeting will be covered in a separate memorandum.

6. The meeting handouts are attached. Additional information on the ROPE study is available at [www.mvp.usace.army.mil/project info/rope/](http://www.mvp.usace.army.mil/project%20info/rope/). If you have questions, you can contact me at 651-290-5623 or by email at kenton.e.spading@mvp02.usace.army.mil.

Attachments

KENTON E. SPADING, P.E.
Hydraulic Engineer

Attendance List/Address and (Area of Concern)
Reservoir Operation Plan Evaluation (ROPE) Meeting, October 26, 2002
Presentation on the Headwaters Reservoirs Water Control Plans and Hydrology

Kenton Spading, Speaker, Water Control, U.S. Army Corps of Engineers, St. Paul, MN
Jeff Kleinert, Dam Operator, Winnibigoshish/Pokegama Reservoirs, Grand Rapids, MN
Michael J. Sneider, Bemidji, MN (Stump Lake)
Dick Labraaten, Bemidji, MN (Lake Bemidji Area)
Ronald L. Crocker, Brainerd, MN
Frank R. Merry, Maplewood, MN (Big Sandy Lake)
Pete Swanson, Bemidji, MN (Big Wolf Lake)
Larry Wannebo, Manhattan Beach, MN (Cross Lake)
Gary Heiling, Brainerd, MN
George Ketchum, Brainerd, MN (Cross Lake)
Ray and Pat Herje, Minneapolis, MN
Jack and Carol Nelson, Plymouth, MN (Cross Lake)
Vic Kreuziger, Pequot Lakes, MN (Cross Lake)
David Bohlander, Brainerd, MN (Gull Lake)
Jim Carlson, McGregor, MN (Big Sandy Lake)
Bob Greifzu, McGregor, MN (Big Sandy Lake)
Ron DeLaHunt, Pequot Lakes, MN (Cross Lake/Whitefish Chain)
Don Engen, Crosslake, MN (Cross Lake)
Steve Heins, East Gull Lake, MN (Gull Lake River)

Table 1
Mississippi River Headwater Reservoir System
Operating Elevation and Stages in Feet

	Winni- bigoshish	Leech	Poke- gama	Sandy	Cross L. Pine R.	Gull
1. Normal Summer Range/Band Stage in Feet Middle of the Summer Band Elev.	1297.94-1298.44 9.0 - 9.5 1298.19	1294.50-1294.90 1.8 - 2.2 1294.70	1273.17-1273.67 8.75 - 9.25 1273.42	1216.06-1216.56 8.75 - 9.25 1216.31	1229.07-1229.57 12.75 - 13.25 1229.32	1193.75-1194.00 6.0 - 6.25 1193.87
2. Ordinary Operating Limits Stage in Feet	1296.94-1300.94 8.0 - 12.0	1293.20-1295.70 0.5 - 3.0	1270.42-1274.42 6.0 - 10.0	1214.31-1218.31 7.0 - 11.0	1227.32-1230.32 11.0 - 14.0	1192.75-1194.75 5.0 - 7.0
3. Present/Total Operating Limit Stage in Feet (2002)	1294.94-1303.14 6.0 - 14.2	1292.70-1297.94 0.0 - 5.24	1270.42-1278.42 6.0 - 14.0	1214.31-1221.31 7.0 - 14.0	1225.32-1235.30 9.0 - 18.98	1192.75-1194.75 5.0 - 7.0
4. Federal Regulations, Title 33, Min. Level and Ave. Annual Flow	1294.94 / 6.0 150 cfs	1292.70 / 0.0 70 cfs	1270.42 / 6.0 200 cfs	1214.31 / 7.0 80 cfs	1225.32 / 9.0 90 cfs	1192.75 / 5.0 30 cfs
5. Public Law 100-676, Sect. 21 Cong. Notification Levels, WRDA 88	1296.94/1303.14 8.0 / 14.2	1293.20/1297.94 0.5 / 5.24	1270.42/1276.42 6.0 / 12.0	1214.31/1218.31 7.0 / 11.0	1227.32/1234.82 11.0 / 18.5	1192.75/1194.75 5.0 / 7.0
6. MN Dept. of Natural Resources Minimum Flow Guidelines Min. Release Elevation, Stage and Minimum Flow	≥ 1294.94 / 6.0 100 cfs, < 1294.94 50 cfs	≥ 1292.70 / 0.0 100 cfs, < 1292.70 50 cfs	(See Note No. 6.)	≥ 1214.31 / 7.0 20 cfs, < 1214.31 10 cfs	≥ 1225.32 / 9.0 30 cfs, < 1225.32 15 cfs	≥ 1192.75 / 5.0 20 cfs, < 1192.75 10 cfs
7. Flowage Rights Acquired To Elev.: Stage in Feet	1306.86 17.92 +	1301.94 9.24 +	1280.42 16 +	1222.31 15 +	1238.82 22.5 +	1194.75 7
8. Est. Downstream Chan. Cap., cfs	2,000	1,500	6,000	(8.)	2,000-2,500	950
Gage Zero Elev., 1912 M.S.L. adj.	1289.47	1293.23	1264.89	1207.70	(9.)	1188.14
Gage Zero Elev., U.S.E. Datum	1290.08	1293.76	1265.27	1209.00	1218.20	1190.00
Gage Zero Elev., 1929 NGVD	1288.94	1292.70	1264.42	1207.31	1216.32	1187.75

1. The most desirable levels for the summer season.
2. The Ordinary Operating Limits represent the range that minimizes the degree of high and low water damages. The lower limit is the normal drawdown target level for high snow water content, the exception being Leech which uses 1293.80.
3. The Present Operating Limits are in accordance with the latest regulations from Congress or subsequent studies. The upper and lower limits provide maximum storage for flood control and other purposes.
4. Title 33, Code of Federal Regulations, Sect. 207.340(d) prescribes the min. operating limits and min. ave. annual discharges as set forth in the 1936 and (for Leech) 1944 regulations.
5. Public Law 100-676, Section 21, of the Water Resources Development Act of 1988 requires the Secretary of the Army to notify Congress 14 days prior to a reservoir being below the minimum or above the maximum listed here. The District will notify the Secretary well in advance of the 14-day period.
6. The MDNR elev. and flows are based on an informal agreement between the Corps and the MN Dept. of Natural Resources and are followed after taking measures to insure the federal ave. annual flow requirement is met. When Pokegama is below elev. 1273.17 ft., releases are limited to the sum of the Winni. and Leech discharges. In addition, 200 cfs has been adopted as the minimum discharge when Pokegama is at or above elev. 1273.17 ft.
7. Flowage rights on the Cass L. Chain obtained to elev. 1307.86 (18.92 ft. stage).
8. The channel below Sandy Lake is affected by backwater from the Miss. River. The channel capacity below the confluence of the Miss. River and the Leech Lake River is 2,200 cfs. High flows in the 2,000 to 2,500 cfs range from Pine River Dam cause high water problems on Big Pine Lake.
9. 1912 M.S.L. adjustment information for the Pine River Dam gage zero is not available.

Table 2
Drainage and Reservoir Surface Areas of Mississippi River Headwaters Reservoirs

Dam/Reservoir	Drainage Area in Sq. Mi.	Surface Area at Max. Oper. Limit in Sq. Mi.	Ratio of Drainage Area to Surface Area
Winnibigoshish	1,442	179	8.06
Leech	1,163	250	4.65
Pokegama	660 (1)	38	17.37
Sandy	421	20	21.05
Pine/Cross Lake	562	24	23.42
Gull	287	20	14.35

1. The local drainage between Winnibigoshish/Leech and Pokegama = 660 sq. mi.. Total D.A. = 3,265 sq. mi.
2. Of the 6,240 sq. mi. of drainage area that lie above Aitkin, MN, 3,265 sq. mi. are controlled by Winnibigoshish, Leech and Pokegama, 421 sq. mi. are controlled by Sandy, and 2,554 sq. mi. are uncontrolled.

Table 3
Mississippi River Headwaters Reservoirs
Comparative Storage per Change in One Unit of Reservoir Level

	General Ratios of One Unit of Reservoir Volume Enter Table From the Top Row					
Reservoir	1 Unit at Winni =	1 Unit at Leech =	1 Unit at Pokeg =	1 Unit at Sandy =	1 Unit at Pine/Cross =	1 Unit at Gull =
Winni	1.00	1.93	0.26	0.15	0.21	0.20
Leech	0.52	1.00	0.13	0.08	0.11	0.10
Pokegama	3.88	7.49	1.00	0.56	0.81	0.78
Sandy	6.88	13.27	1.77	1.00	1.44	1.38
Pine/Cross	4.78	9.23	1.23	0.70	1.00	0.96
Gull	5.00	9.65	1.29	0.72	1.05	1.00

Examples: A change in storage of 1.0 ft. in Winni = 0.52 ft. in Leech (or 0.1 ft. = 0.052 ft.)
 A change in storage of 1.0 ft. in Leech = 1.93 at Winni and 7.49 at Pokegama
 (Leech has almost twice as much storage as Winnibigoshish)

Table 4
Mississippi River Headwaters Dams
Minnesota Department of Natural Resources Guidelines for Rate of Release Changes

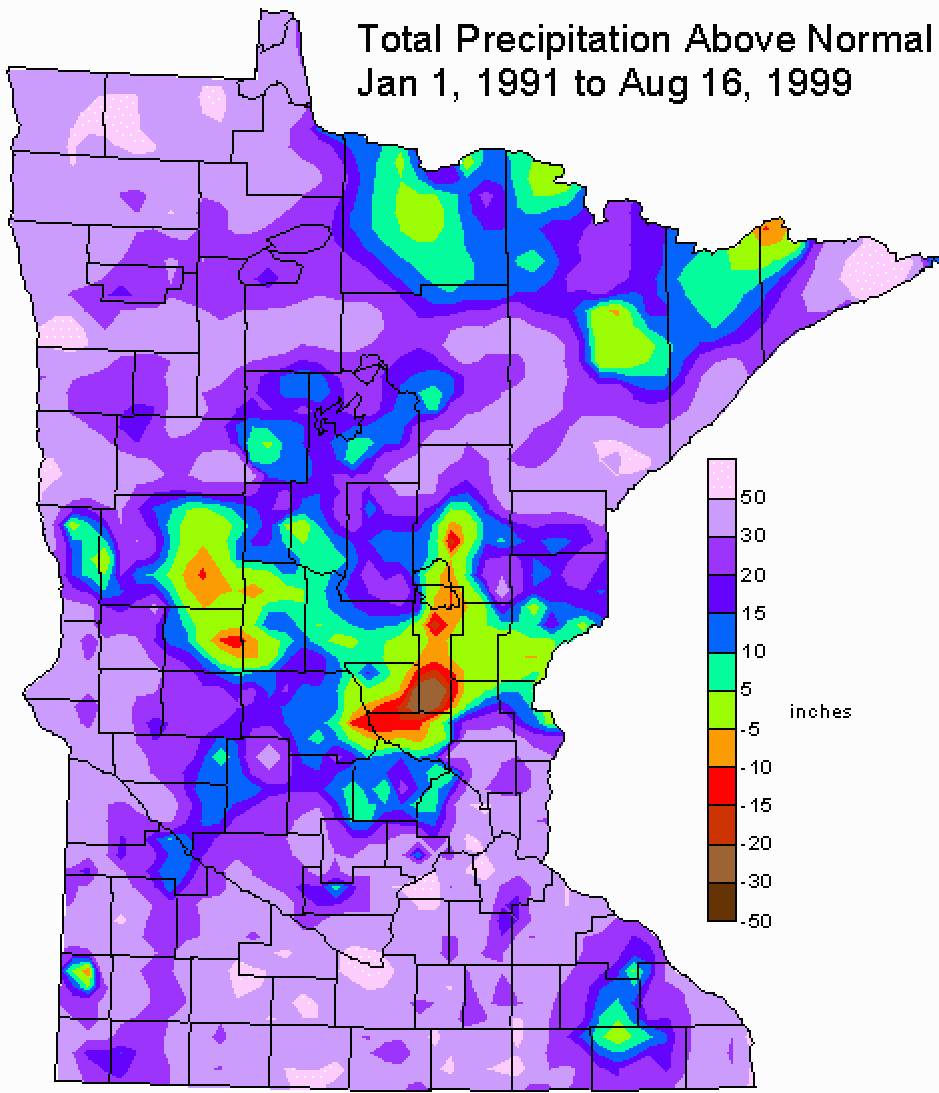
Dam	Rate of Release Guideline
Winni-bigoshish	For increases and decreases, limit changes to approx. 200 cfs/day or a change in the tailwater elevation of not more than 0.5 foot. No more than a 10% change in outflow in any 2-hour period when the USGS gage at Grand Rapids reports an ave. daily flow of 400 cfs or less. No restriction when operating for walleye spawning.
Leech	For increases and decreases, limit changes to approximately 100 cfs per day or a change in the tailwater elevation of not more than 0.25 foot.
Pokegama	Reasonable judgment must be exercised. In general, changes are limited to 20-30% of the total flow except when operating for flood control and/or to prevent property damage. No more than a 10% change in outflow in any 2-hour period when the USGS gage at Grand Rapids reports an average daily flow of 400 cfs or less.
Sandy	No guideline was provided. Reasonable judgment must be exercised. In general, changes are limited to 20-30% of the total flow except when operating for flood control and/or to prevent property damage.
Pine/Cross Lake	For increases and decreases, limit changes to approximately 60 cfs per day or a change in the tailwater elevation of not more than 0.25 foot except when operating for flood control and/or to prevent property damage.
Gull	No guideline was provided. Reasonable judgment must be exercised. In general, changes are limited to 20-30% of the total flow except when operating for flood control and/or to prevent property damage.

Note on Source: Plan of Operation, Miss. R. Headwaters, Minnesota Department of Conservation, Division of Fish and Game, 15 August 1963. Not applicable when operating for flood control and/or to prevent property damage. During other times, reasonable judgment must be exercised. For example, a large percent increase or decrease in the magnitude of the flow is not advisable (e.g., going from 300 cfs to 100 cfs in one move). The District's Environmental Section should be consulted when changes are being made during critical flow periods, particularly during low-flow conditions. Two or three gate changes per day may be necessary during critical flow periods to alleviate stress to fish and wildlife resources. For the 10 percent guideline at Winni and Pokeg, see February 1997 MDNR letter.

The following table for Lake Winnibigoshish is an example of Minnesota DNR regulations that exist of all the reservoirs except Pokegama.

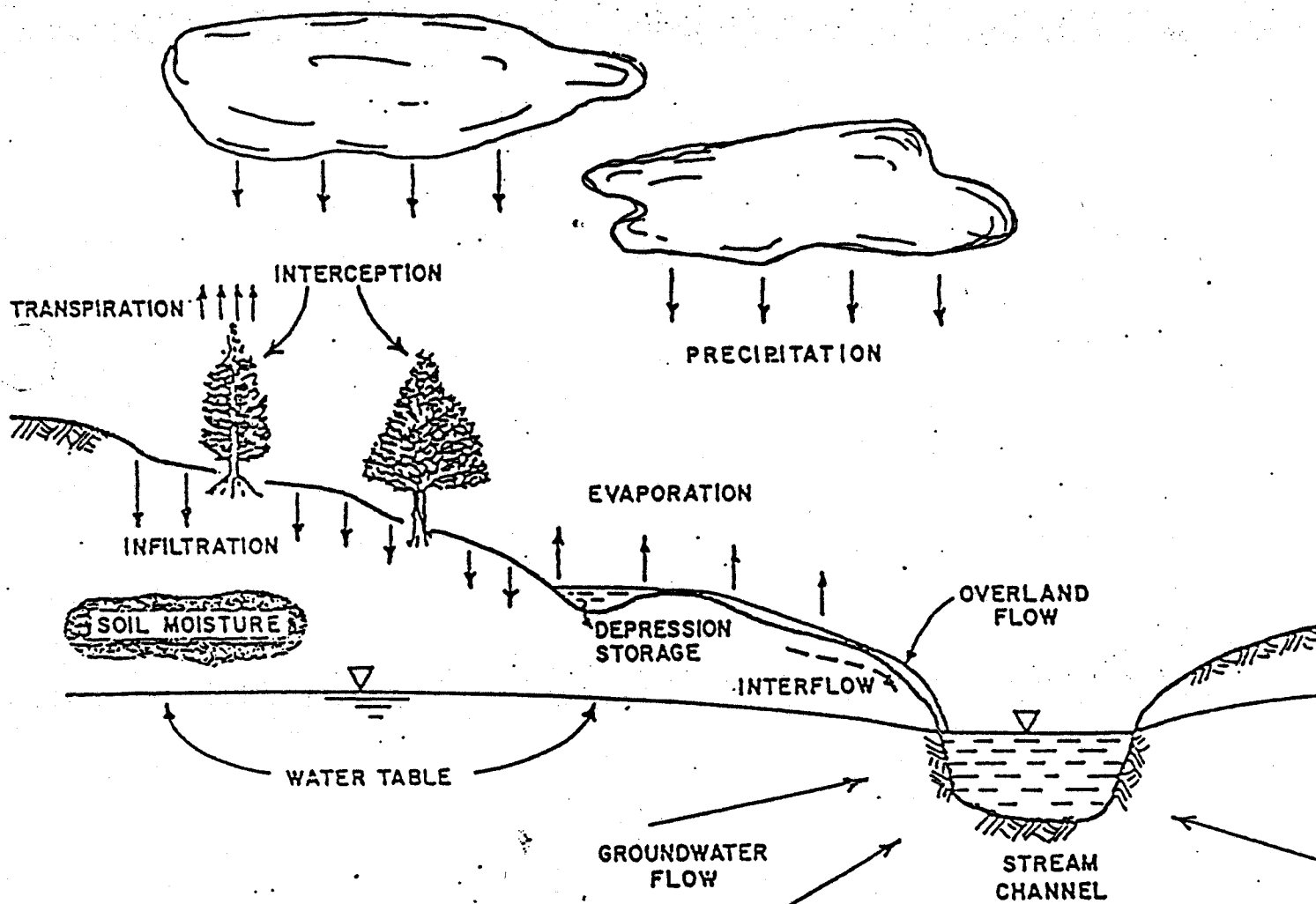
Table 5 Informal Agreement With the Minnesota Department of Natural Resources Maximum Releases From Lake Winnibigoshish Dam	
Reservoir Elevation, Feet	Max Discharge Recommended by MDNR, cfs
1289.94	50
1290.94	100
1291.94	300
1292.94	500
1293.94	700
1294.94	900
1295.94	1100
1296.94	2100
1297.94	3100
1298.19 (9.25 ft. Stage) (1)	
1298.94	4500
1299.19 (10.25 ft. Stage) and above (2)	4500
1. New middle of summer band adopted in 1975 after these guidelines were developed. 2. Middle of summer band in use prior to 1975.	

**Total Precipitation Above Normal
Jan 1, 1991 to Aug 16, 1999**



State Climatology Office
DNR Waters

Hydrologic Cycle



SCHEMATIC REPRESENTATION OF RUNOFF CYCLE